Patent Claims

1. A coated object, comprising a substrate having at least one functional layer, characterized by, that at least one interlayer is arranged in at least one said functional layer, the said interlayer has a layer thickness of $d_z \leq 10$ nm, and the said interlayer interrupts the morphology of the functional layer and devides the said functional layer in partial layers T_S.

2. The coated object as claimed in claim 1, characterized by, that the said interlayer interrupts the morphology of the functional layer at least once, in such a manner that said partial layers T_s are formed and the layer thickness of the partial layers T_s remains below a predetermined layer thickness at which a phase transformation of the functional layer no longer occurs.

3. The coated object as claimed in claim 1, characterized by, that the said functional layer is a predominantly crystalline layer, and the said interlayer interrupts the morphology of the functional layer at least once, in such a manner that said partial layers T_s are formed and the functional layer has dense columns which are laterally tightly cohesive, grow perpendicular to the substrate surface and have substantially no tendency to widen out.

4. The coated object as claimed in claim 1, characterized by, that a said functional layer contains one element selected from the group containing of oxides, nitrides,

carbides, fluorides, chlorides, selenides, tellurides and sulfides.

5. The coated object as claimed in claim 1, characterized by, that a said functional layer contains a plurality of elements selected from the group containing of oxides, nitrides, carbides, fluorides, chlorides, selenides, tellurides and sulfides.

6. The coated object as claimed in claim 1, characterized by, that a said functional layer contains one element selected from the group containing of Li, Be, Na, Mg, Al, Si, Ca, Sc, Ti, Cr, Zn, Ge, Sr, Y, Zr, Nb, Cd, In, Sn, Sb, Te, La, Ce, Pr, Nd, Sm, Gd, Yb, Lu, Hf, Ta, Tl, Pb, Bi and Th.

7. The coated object as claimed in claim 1, characterized by, that a said functional layer contains a plurality of elements selected from the group containing of Li, Be, Na, Mg, Al, Si, Ca, Sc, Ti, Cr, Zn, Ge, Sr, Y, Zr, Nb, Cd, In, Sn, Sb, Te, La, Ce, Pr, Nd, Sm, Gd, Yb, Lu, Hf, Ta, Tl, Pb, Bi and Th.

8. The coated object as claimed in claim 1, characterized by, that a said functional layer contains mixed systems comprising one element selected from a first group containing of oxides, nitrides, carbides, fluorides, chlorides, selenides, tellurides and sulfides, which is compound with at least one element selected from a secound group containing of Li, Be, Na, Mg, Al, Si, Ca, Sc, Ti, Cr, Zn, Ge, Sr, Y, Zr, Nb, Cd, In, Sn, Sb, Te, La, Ce, Pr, Nd, Sm, Gd, Yb, Lu, Hf, Ta, Tl, Pb, Bi and

Th.

9. The coated object as claimed in claim 8, characterized by, that the said mixed systems comprising one element selected from the group metal oxides, metal nitrides and metal carbides.

10. The coated object as claimed in claim 9, characterized by, that the said mixed systems having at least two metallic components.

11. The coated object as claimed in claim 1, characterized by, that a said functional layer contains mixed systems comprising a plurality of elements selected from a first group containing of oxides, nitrides, carbides, fluorides, chlorides, selenides, tellurides and sulfides, which are compound with at least one element selected from a secound group containing of Li, Be, Na, Mg, Al, Si, Ca, Sc, Ti, Cr, Zn, Ge, Sr, Y, Zr, Nb, Cd, In, Sn, Sb, Te, La, Ce, Pr, Nd, Sm, Gd, Yb, Lu, Hf, Ta, Tl, Pb, Bi and Th.

12. The coated object as claimed in claim 11, characterized by, that the said mixed system comprising one element selected from the group metal oxynitrides, metal carbonitrides and metal oxycarbonitrides.

13. The coated object as claimed in claim 12, characterized by, that the said mixed systems having at least two metallic components.

14. The coated object as claimed in claim 1, characterized by, that a plurality of different functional layers are applied to the substrate.

15. The coated object as claimed in claim 1, characterized by, that the said interlayer has a different chemical composition than the said functional layer which is to be interrupted.

16. The coated object as claimed in claim 1, characterized by, that a said interlayer contains one element selected from the group containing of oxides, nitrides, carbides, fluorides, chlorides, selenides, tellurides and sulfides.

17. The coated object as claimed in claim 1, characterized by, that a said interlayer contains a plurality of elements selected from the group containing of oxides, nitrides, carbides, fluorides, chlorides, selenides, tellurides and sulfides.

18. The coated object as claimed in claim 1, characterized by, that a said interlayer contains one element selected from the group containing of Li, Be, Na, Mg, Al, Si, Ca, Sc, Ti, Cr, Zn, Ge, Sr, Y, Zr, Nb, Cd, In, Sn, Sb, Te, La, Ce, Pr, Nd, Sm, Gd, Yb, Lu, Hf, Ta, Tl, Pb, Bi and Th.

19. The coated object as claimed in claim 1, characterized by, that a said interlayer contains a plurality of elements selected from the group containing of Li, Be, Na, Mg, Al, Si, Ca, Sc, Ti, Cr, Zn, Ge, Sr, Y, Zr, Nb,

Cd, In, Sn, Sb, Te, La, Ce, Pr, Nd, Sm, Gd, Yb, Lu, Hf, Ta, Tl, Pb, Bi and Th.

20. The coated object as claimed in claim 1, characterized by, that a said interlayer contains mixed systems comprising one element selected from a first group comprising oxides, nitrides, carbides, fluorides, chlorides, selenides, tellurides and sulfides, which is compound with at least one element selected from a secound group comprising Li, Be, Na, Mg, Al, Si, Ca, Sc, Ti, Cr, Zn, Ge, Sr, Y, Zr, Nb, Cd, In, Sn, Sb, Te, La, Ce, Pr, Nd, Sm, Gd, Yb, Lu, Hf, Ta, Tl, Pb, Bi and Th.

21. The coated object as claimed in claim 20, characterized by, that the said mixed systems comprising one element selected from the group metal oxides, metal nitrides and metal carbides.

22. The coated object as claimed in claim 21, characterized by, that the said mixed systems having at least two metallic components.

23. The coated object as claimed in claim 1, characterized by, that a said interlayer contains mixed systems comprising a plurality of elements selected from a first group comprising oxides, nitrides, carbides, fluorides, chlorides, selenides, tellurides and sulfides, which are compound with at least one element selected from a secound group comprising Li, Be, Na, Mg, Al, Si, Ca, Sc, Ti, Cr, Zn, Ge, Sr, Y, Zr, Nb, Cd, In, Sn, Sb, Te, La, Ce, Pr, Nd, Sm, Gd, Yb, Lu, Hf, Ta, Tl, Pb, Bi and Th.

24. The coated object as claimed in claim 23, characterized by, that the said mixed system comprising one element selected from the group metal oxynitrides, metal carbonitrides and metal oxycarbonitrides.

25. The coated object as claimed in claim 24, characterized by, that the said mixed systems having at least two metallic components.

26. The coated object as claimed in claim 1, characterized by, that the said functional layer is an optical functional layer and the said interlayer interrupts the morphology of the optical functional layer and devides the optical functional layer in partial layer T_s.

27. The coated object as claimed in claim 26, characterized by, that the layer thickness of said optical functions layer is in the range from 10 to 1000 nm.

28. The coated object as claimed in claim 26, characterized by, that the layer thickness of said optical functions layer is in the range from 30 to 500 nm.

29. The coated object as claimed in claim 26, characterized by, that the layer thickness of said partial layers T_s is in the range from 10 to 70 nm.

30. The coated object as claimed in claim 26, characterized by, that the layer thickness of said

partial layers T_s is in the range from 20 to 45 nm.

31. The coated object as claimed in claim 26, characterized by, that the layer thickness d_z of the said interlayer is in the range from 0.3 to 10 nm.

32. The coated object as claimed in claim 26, characterized by, that the layer thickness d_z of the said interlayer is in the range from 1 to 3 nm.

33. The coated object as claimed in claim 26, characterized by, that the layer thickness d_z of the said interlayer is in the range from 1.5 to 2.5 nm.

34. The coated object as claimed in claim 1 , characterized by, that the said coated object comprises an alternating optical layer system made up of a plurality of said functional layers, which are optical functions layer with a high refractive index and optical functional layers with a low refractive index.

35. The coated object as claimed in claim 34, characterized by, that optical functional layers with high refractive index are interrupted by interlayers with a low refractive index.

36. The coated object as claimed in claim 34, characterized by, that optical functional layers with a low refractive index are interrupted by interlayers with a high refractive index.

37. The coated object as claimed in claim 34, characterized by, that the optical functional layer with a high

refractive index contains one element selected from the group containing of titanium oxide, titanium aluminum oxide and zirconium oxide.

38. The coated object as claimed in claim 36, characterized by, that the interlayer with a high refractive index contains one element selected from the group containing of titanium oxide, titanium aluminum oxide and zirconium oxide.

39. The coated object as claimed in claim 34 , characterized by, that the optical functional layer with a low refractive index comprises silicon oxide.

40. The coated object as claimed in claim 35, characterized by, that the interlayer with a low refractive index comprises silicon oxide.

41. The coated object as claimed in claim 26, characterized by, that the substrate contain one element selected from the group containing of metal, glass, glass-ceramic, composite and plastic.

42. The coated object as claimed in claim 26, characterized by its use as an optical element, which can be one element selected from the group containing of reflector for digital projection, lens for digital projection, mirror for digital projection, illumination means for digital projection, reflector for stage, lens for stage, illumination means for stage, reflektor for architectural lighting, lens for architectural lighting, illumination means for architectural lighting, prism for the UV wavelength region, lens for

the UV wavelength region, mirror for the UV wavelength region, reflector for the UV wavelength region, filter for the UV wavelength region, illumination means for the UV wavelength region, prism for the IR wavelength region, lens for the IR wavelength region, mirror for the IR wavelength region, reflector for the IR wavelength region, filter for the IR wavelength region, illumination means for the IR wavelength region, display for monitors, display units.

43. The coated object as claimed in claim 1, characterized by, that the said functional layer is made from a metal and the said interlayer, which interrupted the morphology of this functional layer is made from a metal oxide.

44. The coated object as claimed in claim 43, characterized by, that the functional layer comprises chromium and the interlayer comprises chromium oxide.

45. The coated object as claimed in 43, characterized by its use as a carrier element for lithographic processes.

46. The coated object as claimed in claim 1, characterized by, that the said functional layer is an protektive layer and the said interlayer interrupts the morphology of the protective layer and devides the protective layer in partial layers T_s.

47. The coated object as claimed in claim 46, characterized by, that the layer thickness of said

protective layer is in the range from 100 to 20,000 nm.

48. The coated object as claimed in claim 46, characterized by, that the layer thickness of said protective layer is in the range from 500 to 10,000 nm.

49. The coated object as claimed in claim 46, characterized by, that the layer thickness of said protective layer is in the range from 1500 to 5000 nm.

50. The coated object as claimed in claim 46, characterized by, that the layer thickness of said partial layers T_s is in the range from 30 to 500 nm.

51. The coated object as claimed in claim 46, characterized by, that the layer thickness of said partial layers T_s is in the range from 100 to 250 nm.

52. The coated object as claimed in claim 46, characterized by, that the layer thickness d_z of the said interlayer is in the range from 0.3 to 10 nm.

53. The coated object as claimed in claim 46, characterized by, that the layer thickness d_z of the said interlayer is in the range from 1 to 5 nm.

54. The coated object as claimed in claim 46, characterized by, that the said protective layer interrupted by interlayers has a morphologie with columns which on average have a lateral extent of less than 1 µm.

55. The coated object as claimed in claim 46, characterized by, that the said protective layer interrupted by

interlayers has a morphologie with columns which on average have a lateral extent of less than 200 nm.

56. The coated object as claimed in claim 46, characterized by, that the protective layer comprises silicon nitride.

57. The coated object as claimed in claim 46, characterized by, that the protective layer comprises zirconium oxide in a thermally stable crystal phase.

58. The coated object as claimed in claim 46, characterized by, that the interlayer contain one element selected from the group containing of zirconium nitride, silicon oxide and titanium aluminum oxide.

59. The coated object as claimed in claim 46, characterized by, that the substrate contains one element selected from the group containing of glass, glass-ceramic and nonmetallic crystalline materials.

60. The coated object as claimed in claim 46, characterized by its use as a cooking plate for a cooking hob.

61. A coated object, comprising a substrate having at least one functional layer, characterized by, that at least one interlayer, which is different than the functional layer, is arranged in at least one functional layer, the interlayer having the same refractive index as the functional layer and the interlayer forming a layer which interrupts the morphology of the functional layer.

62. The coated object as claimed in claim 61, characterized by, that the functional layer comprises a metal oxide and the interlayer comprises a metal oxide having at least two metallic components and the refractive index of the interlayer can be varied by adjusting the quantitative ratio of the metallic components.

63. The coated object as claimed in claim 61, characterized by, that the functional layer comprises zirconium oxide and the interlayer comprises titanium aluminum oxide and the refractive index of the interlayer can be varied by adjusting the quantitative ratio of titanium and aluminium.

64. The coated object as claimed in claim 61, characterized by, that the interlayer comprises a metal oxide and the functional layer comprises a metal oxide having at least two metallic components and the refractive index of the functional layer can be varied by adjusting the quantitative ratio of the metallic components.

65. The coated object as claimed in claim 61, characterized by, that the interlayer comprises zirconium oxide and the functional layer comprises titanium aluminum oxide and the refractive index of the functional layer can be varied by adjusting the quantitative ratio of titanium and aluminium.

66. A coated object, comprising a substrate having at least one optical functional layer with a layer thickness between 20 and 1,000 nm and which is a predominantly amorphous layer, characterized by, that in at least one said functional layer is arranged at least one

interlayer which is different than the functional layer, which has a different morphology than the functional layer, which has a layer thickness $d_z \leq 10$ nm and which devides the said functional layer in partial layers T_s, so that the layer thickness of the partial layers T_s is between 10 and 50 nm.

67. A coated object, comprising a substrate having at least one optical functional layer with a layer thickness between 20 and 1,000 nm and which is a predominantly crystalline layer in a thermally instable crystal phase, characterized by, that in at least one said functional layer is arranged at least one interlayer which is different than the functional layer, which has a different morphology than the functional layer, which has a layer thickness $d_z \leq 10$ nm and which devides the said functional layer in partial layers T_s, so that the layer thickness of the partial layers T_s is between 10 and 50 nm.

68. A coated object, comprising a substrate having at least one protective functional layer with a layer thickness between 100 and 20,000 nm and which is a predominantly crystalline layer in a thermally stable crystal phase, characterized by, that in at least one said functional layer is arranged at least one interlayer which is different than the functional layer, which has a different morphology than the functional layer, which has a layer thickness $d_z \leq 10$ nm and which devides the said functional layer in partial layers T_s, so that the layer thickness of the partial layers T_s is between 30

and 500 nm.

69. The coated object as claimed in claim 1, characterized by its use as a diffusion-inhibiting container.

70. A process for producing the coated object as claimed in claim 1, characterized by, that the coating is applied using a CVD or PVD process.

71. The process for producing a coated object as claimed in claim 2, characterized by, that the coating is applied using a reactive CVD process, preferably selected from the following group:
- PICVD (plasma impulse chemical vapor deposition)
- PECVD (plasma-enhanced chemical vapor deposition)
- PACVD (plasma-assisted chemical vapor deposition)
- TCVD (thermal chemical vapor deposition)

72. The process for producing a coated object as claimed in claim 71, characterized by, that the coating is applied discontinuously in the form of pulse cycles, the thickness of a respective functional layer and interlayer being set by means of the number of cycles.

73. The process for producing a coated object as claimed in claim 71, characterized by, that in each case the lowest layer thickness, which is applied in precisely one pulse cycle, can be set to 0.1 to 0.3 nm.

74. The process for producing a coated object as claimed in claim 3, characterized by, that the coating is applied using a reactive PVD process, preferably using

magnetron sputtering.

75. The process for producing a coated object as claimed in claim 3, characterized by, that the coating is applied using a reactive ion beam-assisted PVD process, preferably using ion beam-assisted ion beam sputtering or ion beam-assisted electron beam evaporation coating.